Student Number ___________ Stud

University of Saskatc

EE 352 Communication

Quiz #3 – Apr.4/200

Time: 25 minutes

Permitted: - text, printed notes, student's own *hand-written* materials 5

Use the space below each question for your answer.

7/10

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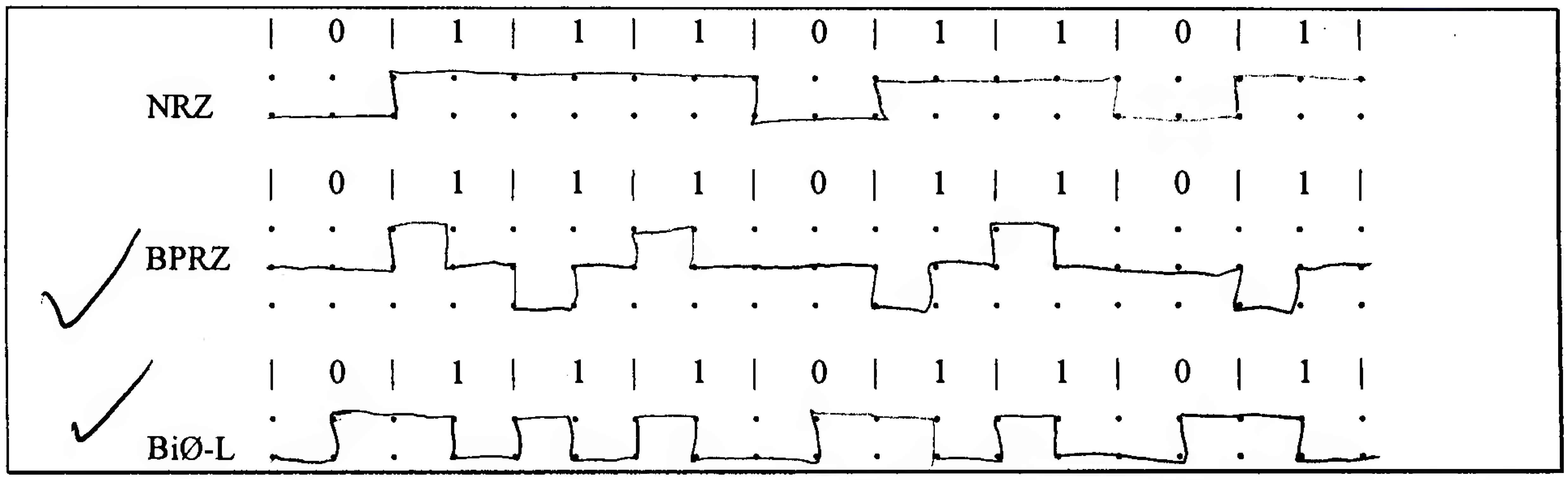
1 Illustrate non-return to zero (NRZ), bipolar return to zero (BPRZ) and Manchester (biphase-level) coding for the following binary sequence (2 pts)

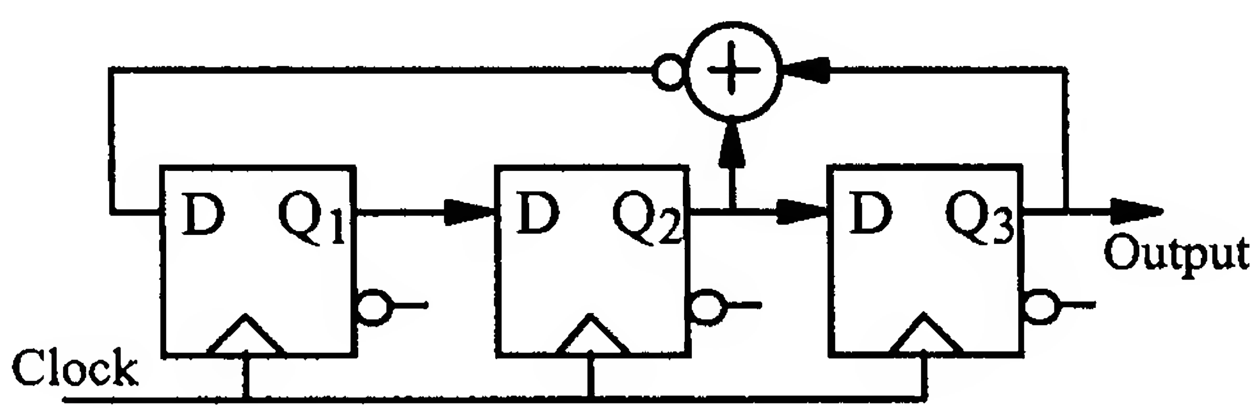


*2 A three-stage shift register is connected to produce a pseudorandom binary sequence (PRBS). This is also known as a maximal length (ML) or pseudonoise (PN) sequence. Assume that the resisters start in the all zero state (000) and that the output voltage levels are ±2 volts. The clock frequency is 7 MHz (3 pts)

1 i) What is the length and bit pattern of the output sequence? How often does the sequence repeat?

1 ii) Sketch the two-sided spectrum (Fourier series) of the output. Calibrate the frequency and amplitude scales in your illustration and include units.

Ø iii) Calculate the power in the time domain. Consider Parseval's Theorem and estimate the power in the frequency domain up to the first spectral null.



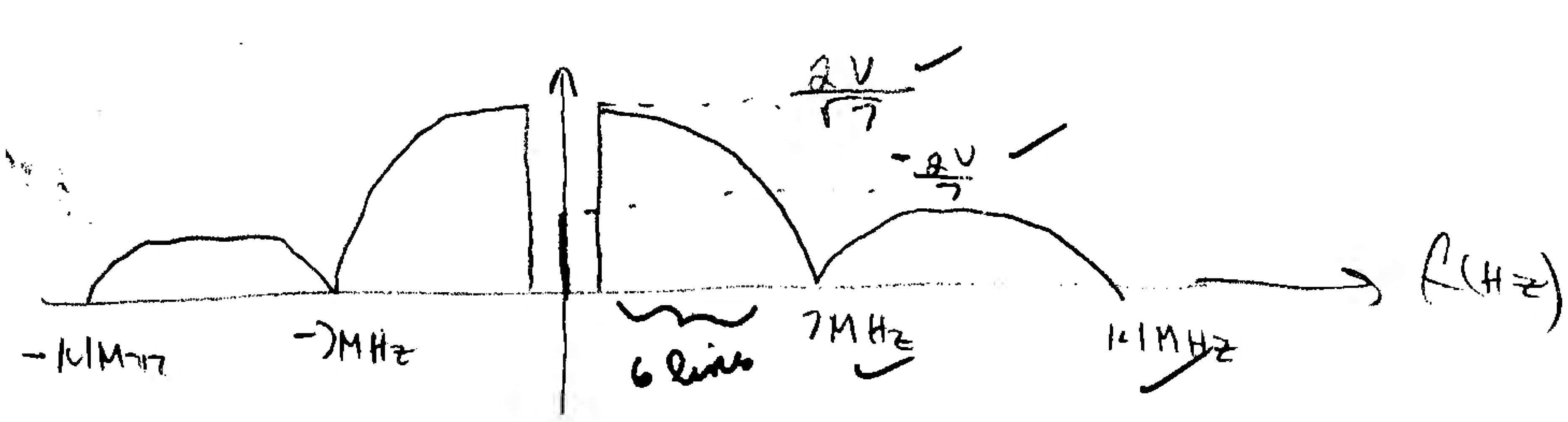
0 0 0	0
1 0 0	0
1 1 0	0
0 1 1	1
1 0 1	1
0 1 0	0
0 0 1	1

1) $2^3-1 = 8-1 = 7$ ✓

if CLK = 7MHz $T = \frac{1}{7MHz} = 149.85$ ns

7T = 1 μs repeat every 1 μs ✓

ii)



iii) pow is ... with amplitude 2V

*3 a) Complete the table below for digital transmission signals used in North America. (1 pt)

	DS1	DS1-C	DS3	STS-1
Number of voice signals	24 ✓	48	672	672
Transmission bit rate (Mb/s)	1.544	3.152	44.736	51.84 ✓
Number of bits per Multiframe (or STS-1 frame)	3316 ✓	1272	4760	6480
Duration of the Multiframe (us)	1500	403.6 ✓	106.4	125
Nuumber of framing bits per Multiframe (or STS-1 frame)	12	12	31	16
Checksum (truncated)	3853	1738	5614	7344

←-1

b) What is the probability that a given 16 bits of random data will resemble the STS-1 framing word? What is the probability that this pattern will occur at least once within the "random" data (or other overhead) portions of a 125 us STS-1 frame? (1 pt)

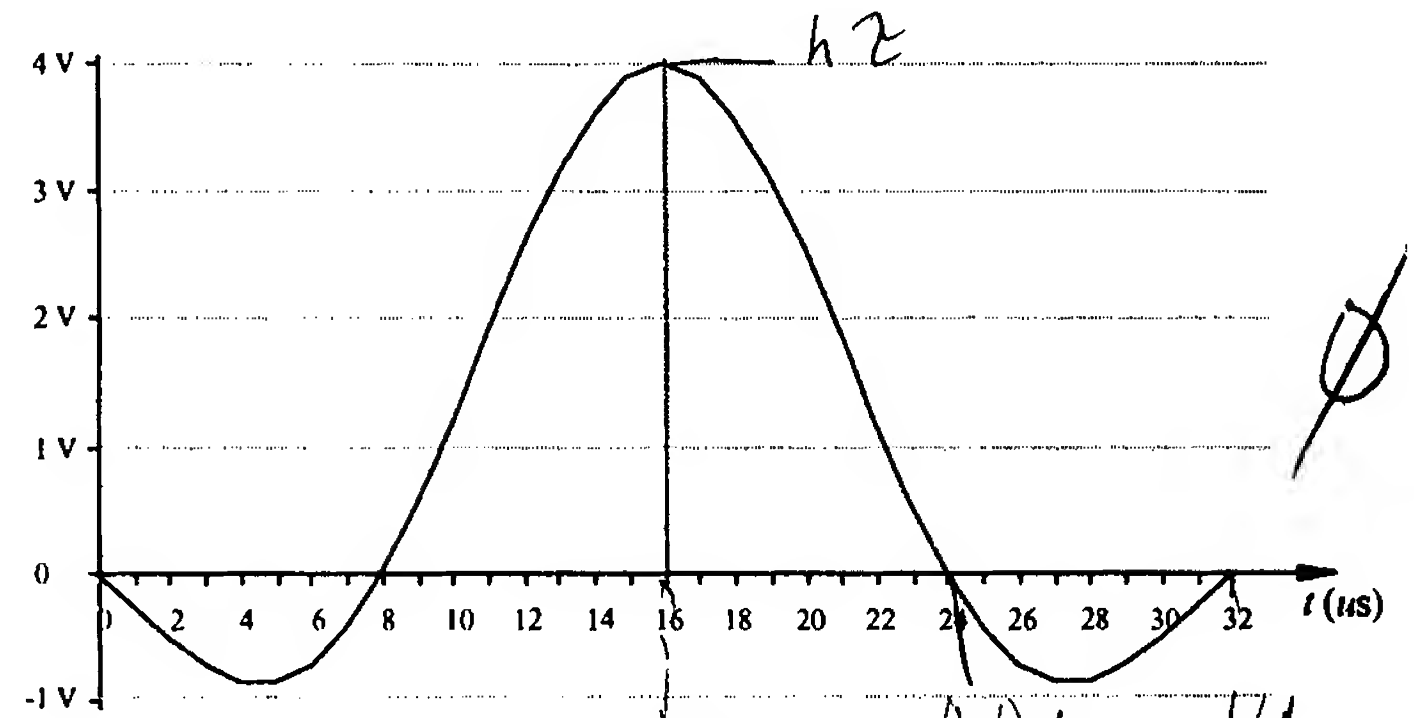
Bad Wording

a) $P = 1 - (1 - 2^{-16})^{512} = 7.7 \times 10^{-3}$ (6479)

B) $P_{FA} = 2^{-16} = 15.26 \times 10^{-6}$ ✓

*4 A transversal filter is constructed from a binary shift register with 16 taps. The transversal filter is arranged to generate an approximation to a single sin $\pi f_b t/\pi f_b t$ pulse truncated at $t = 2/f_b$ where the bit rate f_b = 100 kb/s. The clock rate of the shift register is 4 times the bit rate thus each sidelobe of the time response has 4 samples and the main lobe has 8 samples. The peak voltage of the transmitted pulse is 4 volts. (3 pts)

i) On scales below, sketch the time response of the filter output (i.e. the approximation).
ii) On a two-sided calibrated frequency axis, sketch the spectrum of the transmitted signal if the sin $\pi f_b t/\pi f_b t$ pulse were not truncated.
iii) Approximately sketch the spectrum of the truncated transmitted pulse. Note that the transmitted pulse can be modeled as the product of a single sin $\pi f_b t/\pi f_b t$ pulse and a gating pulse and that the resulting spectrum is the convolution of the two spectra in the product.



END

4 = t A

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